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THE CLAIMS

I claim:

1. An analytical method for determining whether a DNA sample comprises double-stranded DNA, said method comprising analyzing the DNA sample by near field Raman spectroscopy to determine whether the sample produces lattice vibrations, wherein the presence of lattice vibrations indicates the presence of double stranded DNA in the DNA sample.

2. The method of claim 1 wherein DNA sample is associated with a substrate selected from the group consisting of: nucleic acid chips, peptide nucleic acid chips, conducting carbon nanotube plates, and microfluidic nucleic acid chips.

3. An analytical system for determining whether a DNA sample comprises double-stranded DNA, said system comprising:

   (a) a sample retention structure;

   (b) a radiation source arranged to irradiate the sample retention structure to produce photonic scattering from a sample on said sample retention structure; and

   (c) an electronics unit comprising:

      (i) a photonic collector;

      (ii) a Raman spectrograph; and

      (iii) spectral analyzer

      arranged to analyze the DNA sample by near field Raman spectroscopy to determine whether the sample produces lattice vibrations, wherein the presence of lattice vibrations indicates the presence of double stranded DNA in the DNA sample.

4. A spectroscopic system for detecting molecular hybridization, said system comprising:

(a) a near-field SERS substrate arranged to support one or more predetermined hybridizeable molecules thereon;

(b) a source of coherent radiation source arranged to impinge coherent radiation onto each of the hybridizeable molecules to responsively produce a pattern of scattered photons;

(c) a photonic collector arranged in photon-gathering relationship to the photons and adapted to transmit the gathered scattered photons;

(d) a Raman spectrograph arranged in photon receiving relationship to the photonic collector and adapted to generate an output correlative to the collected scattered photons transmitted by the photonic collector; and

(e) a spectral to electronic converter, arranged to receive the output of the Raman spectrograph and to convert same to an electronic output indicative of the presence or absence of hybridized molecules on the SERS substrate.

5. The system of claim 4 wherein the near field SERS substrate is selected from the group consisting of: nucleic acid chips, peptide nucleic acid chips, conducting carbon nanotube plates, microfluidic nucleic acid chips, and optical nanocluster microchips.

6. The system of claim 4 wherein the SERS substrate is selected from the group consisting of: plates coated with colloid silver, plates coated with colloid gold, plates coated with colloid platinum, and conducting carbon nanotube plates.

7. The system of claim 4 wherein the one or more predetermined hybridizeable molecules disposed on the near field SERS substrate are selected from the group consisting of: DNA and RNA.

8. T The system of claim 4 wherein the near field SERS substrate comprises a microchip.

9. The system of claim 4 wherein the near field SERS substrate comprises a microarray.

10. The system of claim 4 wherein the laser light source is selected from the group consisting of: argon ion lasers, infrared lasers, and ultraviolet lasers.

11. The system of claim 4 wherein the spectral to electronic converter comprises a CCD array.

12. The system of claim 4 wherein the photonic collector comprises an ICCD array.

13. A method for detecting hybridized DNA comprising:

(a) providing a spectroscopic system for detecting molecular hybridization, said system comprising:

(i) a near-field SERS substrate arrayed to support one or more predetermined hybridizeable molecules thereon;

(ii) a source of coherent radiation source arranged to impinge coherent radiation onto each of the hybridizeable molecules to responsively produce a pattern of scattered photons;

(iii) a photonic collector arranged in photon-gathering relationship to the photons and adapted to transmit the gathered scattered photons;

(iv) a Raman spectrograph arranged in photon receiving relationship to the photonic collector and adapted to generate an output correlative to the collected scattered photons transmitted by the photonic collector; and

(v) a spectral to electronic converter, arranged to receive the output of the Raman spectrograph and to convert to an electronic output indicative of the presence or absence of hybridized molecules on the SERS substrate;

(b) exposing the predetermined hybridizeable molecules disposed on the near field SERS substrate to a sample containing one or more sample molecules having the capacity to hybridize to the predetermined hybridizeable molecules;

(c) directing the laser beam from the laser light source onto each of the one or more predetermined hybridizeable molecules to create a pattern of scattered photons for each of said hybridizeable molecules;

(d) collecting the scattered photons for each of said hybridizeable molecules and directing them to the Raman spectrograph;

(e) collecting photonic data from the Raman spectrograph and transforming said photonic data into electronic data for further data processing; and

(f) determining whether each of the hybridizeable molecule is hybridized to a sample molecule by comparing the Raman spectrum of (i) each hybridizeable molecule exposed to the sample to (ii) the Raman spectrum to the corresponding unhybridized predetermined hybridizeable molecule.

14. The method of claim 13 wherein the hybridizable molecule comprises DNA and wherein the determination of whether the hybridizeable molecule is hybridized to a sample molecule is indicated by the presence of lattice vibrations.

15. The method of claim 13 wherein the near field SERS substrate is selected from the group consisting of: nucleic acid chips, peptide nucleic acid chips, conducting carbon nanotube plates, microfluidic nucleic acid chips, and optical nanocluster microchips.

16. The method of claim 13 wherein the SERS substrate is selected from the group consisting of: plates coated with colloid silver, plates coated with colloid gold, plates coated with colloid platinum, and conducting carbon nanotube plates.

17. The method of claim 13 wherein the one or more predetermined hybridizeable molecules disposed on the near field SERS substrate are selected from the group consisting of: DNA and RNA.

18. The method of claim 13 wherein the near field SERS substrate comprises a microchip or microarray.

19. The method of claim 13 wherein the laser light source is selected from the group consisting of: argon ion lasers, infrared lasers, and ultraviolet lasers.

20. The method of claim 13 wherein the spectral to electronic converter comprises a CCD array and/or wherein the photonic collector is an ICCD array.